AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Clarity Movement Co./
Node
Pollutants:
$PM_{2.5}$ mass concentration

Measurement Range:
0 - 1000 µg/m³

Type: Optical

Additional Information

Field evaluation report:
http://www.aqmd.gov/aq-spec/evaluations/field

Lab evaluation report:
http://www.aqmd.gov/aq-spec/evaluations/laboratory

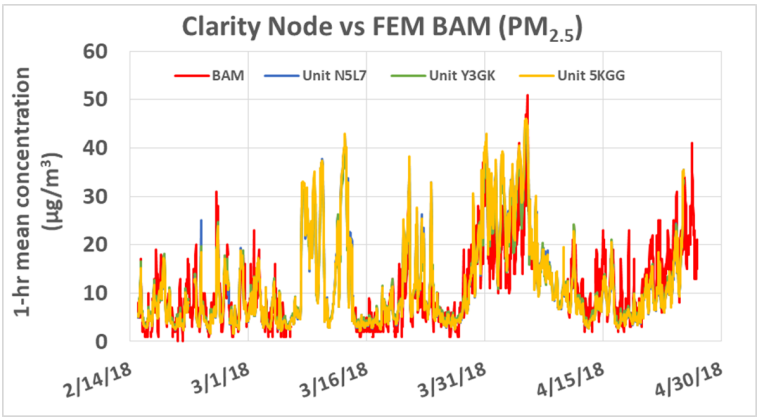
AQ-SPEC website:
http://www.aqmd.gov/aq-spec

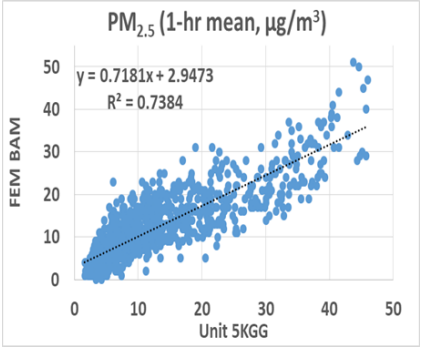
Evaluation Summary

- Three Clarity Node sensors (IDs: N5L7, 5KGG and Y3GK) were tested in the field and two sensors were tested in the laboratory (IDs: N5L7 and 5KGG. Unit Y3GK was not able to report data during lab evaluation)
- Overall, the two Clarity Node sensors showed low to high accuracy, compared to FEM GRIMM for a concentration range between 0 to 450 µg/m³. Accuracy increased as concentration increased.
- The Clarity Node sensors exhibited high precision for all T/RH combinations and all $PM_{2.5}$ concentrations.
- The Clarity Node sensors showed low intra-model variability.
- Data recovery was 100% from both units.
- For $PM_{2.5}$ mass conc., the Clarity Node sensors had good correlation with the FEM BAM from both the field (R^2 ~ 0.73-0.76) and laboratory studies (R^2 > 0.99 with the FEM GRIMM).

Field Evaluation Highlights

- Deployment period 02/15/2018 - 04/25/2018: the three Clarity Node sensors showed good correlations with the $PM_{2.5}$ mass concentration monitored by FEM BAM.
- The units showed > 97% data recovery and very low intra-model variability.





Coefficient of Determination (R^2) quantifies how the three sensors followed the $PM_{2.5}$ concentration change by FEM.

An R^2 approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

Laboratory Evaluation Highlights

Accuracy

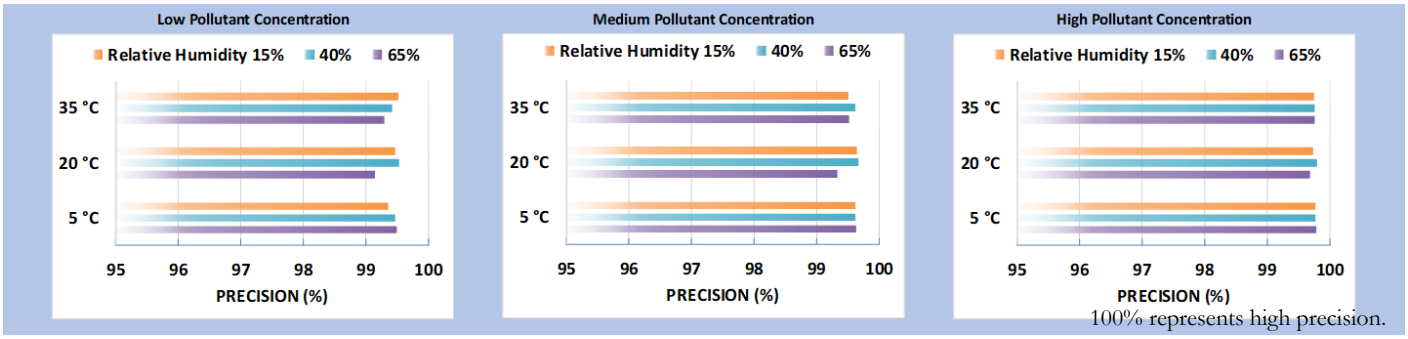
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State #	Sensor mean (µg/m³)	FEM GRIMM (µg/m³)	Accuracy (%)
1	31.2	17.3	19.2
2	52.4	43.5	79.5
3	103.0	88.0	82.9
4	161.2	139.3	84.3
5	313.7	279.2	87.7
6	494.7	452.6	90.7

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

A negative % means sensors' overestimation. The higher the positive value (close to 100%), the higher the sensor's accuracy.

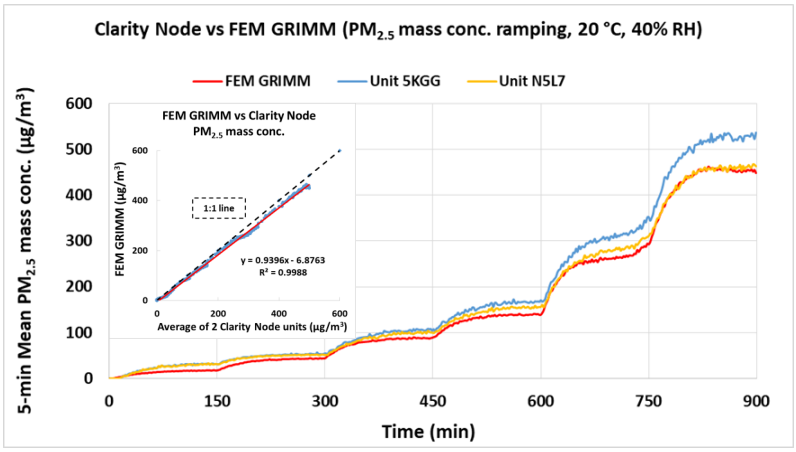
Precision ($PM_{2.5}$)



100% represents high precision.

Sensor's ability to generate precise measurements of $PM_{2.5}$ concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5 °C and 15%) cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

Coefficient of Determination



The two Clarity Node sensors showed excellent correlation with the corresponding FEM $PM_{2.5}$ data ($R^2 > 0.99$) at 20 °C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Clarity Node performance.

Observed Interferents

N/A

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